THE DECLINE OF CARIBOU ON NORTHWEST VICTORIA ISLAND 1980–93

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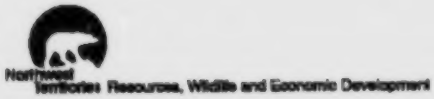
The research documented in this report was carried out prior to the creation of Nunavut.



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ABSTRACT

The evidence for a decline in caribou abundance between 1980 and 1993 on northwest Victoria Island includes reports by hunters of difficulty finding caribou in the early 1990s, and aerial surveys which suggest a decline from an abundance of approximately 4000–6000 in 1980, to 100–300 by 1993. The annual harvest as a proportion of estimated herd size increased between 1980 and 1992 to 30%. The elders of Holman also identified recent over-hunting a cause of the decline. Aerial surveys were completed during both winter and calving, which reduces the likelihood that the reduced abundance was from a shift in distribution. Evidence is inconclusive as to whether predation, competition with muskoxen or winter weather were contributing factors. A survey of local knowledge on wolves provided evidence that wolves have increased during the last decade.

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INTRODUCTION

Hunters from Holman, NWT reported difficulty finding Peary caribou (*Rangifer tarandus pearyi*) in the winters of 1991-92 and 1992-93. Historically, abundance on northwest Victoria Island increased during the 1960s and 1970s from a low in the early 1950s (Appendix A). The first systematic aerial survey in 1980 was part of the environmental assessment for the proposed Polar Gas pipeline. Jakimchuk and Carruthers (1980) estimated 4500 caribou on northwest Victoria Island, but at that time, we were uncertain whether those caribou were from one or more herds. Satellite telemetry (1987-89) allowed us to identify that those caribou were almost certainly the Minto Inlet herd and that there was a second herd, the Dolphin and Union herd that calved and summered on western and central Victoria Island (Gunn and Fournier 2000). Victoria Island is shown in Figure 1. Extrapolating the number of caribou counted while surveying the calving ground north of Minto Inlet in June 1987 (Gunn and Fournier 2000) led to an approximation of 3500 caribou (including calves) in the Minto Inlet herd.

The difficulty that hunters reported in finding caribou in the winters of 1991-92 and 1992-93 suggested either a sharp decline in numbers or a shift in the wintering area. The reports triggered surveys of the wintering areas in March 1992 and March 1993 (Heard 1992, this report Appendix B). Neither survey found more than 200 caribou. Albert Elias, a member of the Wildlife Management Advisory Council (NWT) from Holman started to interview elders about their knowledge of the caribou (Appendix A). Faced with the survey results and knowing the difficulty of finding caribou, the

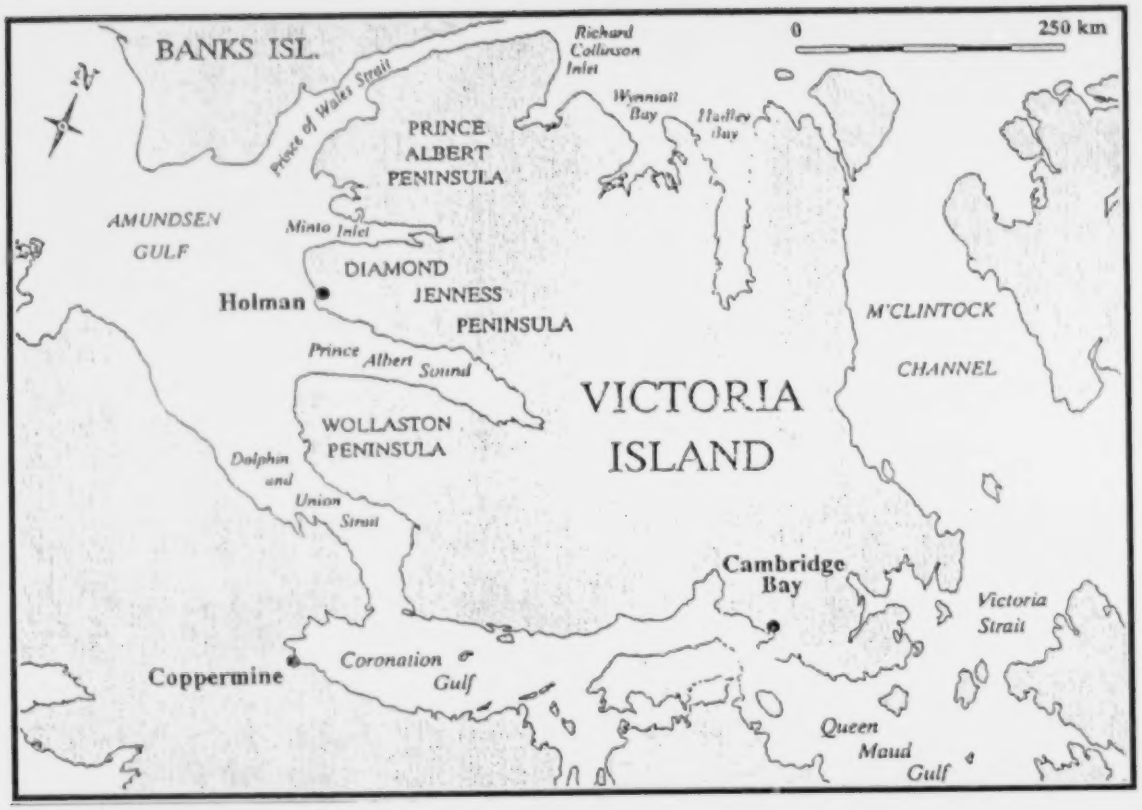

Figure 1. Victoria Island and surrounding area.

community, at a public meeting in April 1993, moved to ban hunting in the Minto Inlet area for 5 years. Follow-up surveys in June 1993 confirmed the low numbers of caribou from northwest Victoria Island (Appendix C).

The decline in the Minto Inlet Herd was not unexpected and that prospect had been suggested to the Hunter's and Trapper's Committee in Holman in 1989 during a meeting explaining the movements of the satellite–collared cows. During the meeting, some hunters commented about seeing more wolves and consequently Colin Adjun (Wildlife Officer) interviewed hunters to record their observations of wolves (Appendix D). The possibility of a decline was based on the known harvest of caribou by hunters

from Holman. The harvest of Minto Inlet caribou averaged 674 ± 268 SD until 1987-88 when the harvest started to decline (Table 1), although hunters did not report difficulty in finding caribou until 1991.

This report was first drafted in 1993 with the objective of bringing together information on the decline in numbers of caribou and on what factors may have driven the decline. However, the report was not completed and subsequently some of the original contents have become redundant because of work undertaken principally by John Nagy (RWED Inuvik), or because the information has been published separately (Nishi and Buckland 2000, Gunn and Fournier 2000). In particular, Nishi and Buckland (2000) surveyed western Victoria Island in June 1994 to determine the abundance and distribution of the Minto Inlet herd and to delineate the calving distribution of the Dolphin and Union herd. Their subsequent report reviews the previous caribou surveys on Victoria Island and includes a chronology of the management issues (1987–1994) surrounding the decline of caribou on northwest Victoria Island.

This version of the 1993 draft report has kept the original objective, as the unpublished information is relatively fragmented. The report includes details of the March and June 1993 aerial surveys, and the results of interviewing elders from Holman about the caribou decline and wolves. I have also included as an appendix, the movements of four caribou cows fitted with satellite collars in the Shaler Mountains in 1996 which have not been reported elsewhere. The movements of those caribou contributes to

interpreting the June 1994 survey relative to the decline of caribou on northwest Victoria Island 1980–93.

On northwest Victoria Island, the caribou are relatively small and similar to the caribou on Banks Island in appearance. People from Holman call them Peary caribou. In this report, the caribou on northwest Victoria Island are identified as the Minto Inlet herd based on their calving north of Minto Inlet (Gunn and Fournier 2000).

Manning (1960) provided the first scientific description of caribou on Victoria Island, and he referred to the smaller bodied "resident" caribou on northwest Victoria Island. However, he did not have skulls or hides to measure and describe these resident caribou. Manning (1960) did measure skulls and describe hide colouration from the caribou that summered on Victoria Island and migrated to the mainland for the winter. He named them after the Dolphin and Union Strait and described them as more related to barren–ground caribou. Some people from Holman refer to the Dolphin and Union herd as mainland caribou, but people from Cambridge Bay call caribou from the Dolphin and Union herd Peary or island caribou to distinguish them from barren–ground caribou. Dolphin and Union caribou, although having a larger body mass than Minto Inlet caribou, have the light grey antler velvet and body proportions (length of leg, relative hoof size) and skull proportions more typical of Peary caribou than barren–ground caribou. The skull measurements of caribou collected in the early 1900s (Manning 1960) are not significantly different from skulls of caribou collected 1986-90 on southern Victoria Island (Gunn and Fournier 1996).

In the late 1990s, John Nagy led the way for the collection of tissue samples and collaborated with Keri Zittslau (University of Alberta) for nuclear DNA analysis of the caribou tissue. The Minto Inlet and Dolphin and Union herds were distinct from each other and the Minto Inlet herd was most closely related to the caribou on Banks Island (Zittslau *et al.* In Prep.)

EVIDENCE FOR THE DECLINE:

The first line of evidence for a decline is from the aerial surveys used to estimate abundance. However, the evidence for the decline is more quantitative than qualitative. That is, we cannot measure the rate of decline because of the differences in the objectives, timing and survey techniques. Rates of change usually have to be measured at approximately the same time of year in birth-pulse species (Caughley 1977).

Comparing the estimates from August 1980 (4512 ± 988 S.E., Jakimchuk and Carruthers 1980) and June 1987 (3500, Gunn and Fournier 2000) does not shed much light on the trend in abundance, as the 1987 survey was not designed to estimate herd abundance but instead was designed to map calving distribution. We estimated 643 ± 172 (S.E.) caribou on the calving area in June 1987. We did not see any bulls and the caribou were frequently inconspicuous on the mottled snow and bare-ground. If we assume that most bulls were not on the area and that we missed about half the caribou on transect, then that exercise would place the population at roughly 2,600. Jakimchuk and Carruthers (1980) do not specify, but their estimate appears to include calves, whereas the June 1987 estimate excludes calves. If calves are included, our ballpark estimate would increase to 3500. However, Jakimchuk and Carruthers (1980) believed that they missed anywhere between 15% and 30% of the caribou.

The 1987 and 1993 June surveys are comparable in timing and methods although the area covered in June 1993 was considerably greater (Appendix C). That comparison suggests a marked reduction. Between 13 and 15 June 1993, R. Morrison flew 2114 km of transects spaced systematically across northwest Victoria Island and counted 15 caribou and one calf (Appendix C). Coverage was about 10%, which suggests there were about 160 – 300 caribou on northwest Victoria Island. The August 1980 and June 1993 surveys are comparable in area covered and relatively similar in methods (1 km transect width, 120 m agl and 160 km/h).

The estimates derived from the March 1992 (Heard 1992) and March 1993 surveys (Appendix B) were 170 ± 54 and 144 ± 22 (S.E.) but the survey methodology differed. Heard's (1992) survey was more designed for counting muskoxen and he flew higher (183 m agl) and with a wider strip width (I km either side of the aircraft). Heard (1992) commented that caribou would have been easily overlooked and the actual densities could have been 4 times higher.

The second line of evidence for the decline is the difficulty that hunters have had in finding caribou in the 1992 and 1993 winters. Hunters reported that they had to travel extensively around Minto Inlet (J. Haluksit, G. Bristowe, J. Kunyuna pers. comm.) especially in the 1992/93 winter.

CAUSES OF THE DECLINE:

The possible causes of the decline in caribou abundance on northwest Victoria Island could be movement to another part of the island or deaths exceeding births. Harvesting and predation are the most likely causes of caribou deaths, although in some years malnutrition caused by difficulty in obtaining forage could also have been a cause of death. Annual variations in fecundity in relation to condition occur (Thomas 1982) especially during periods of restricted forage.

Harvesting:

The earliest information on caribou harvests at Holman is from Usher (1965) who reported the harvest of caribou to be about 150-200 caribou in 1960, which would include 15-20 taken on Banks Island. At about that time, Macpherson (1961) had extrapolated from sightings that there were as few as 670 caribou on Victoria Island. Jacobson (1980) reported that the caribou harvest was believed by the hunters to range between 700 and 1000 caribou a year mostly from east and northeast of Holman.

The Kitikmeot Harvest Study started in 1983 (Gunn *et al.* 1986, D'Hont and Croft 1995) and ran until the Inuvialuit Harvest Study replaced it in 1989. Hunters reported that the caribou taken in the summer were different in appearance from the type of caribou taken in the fall and winter. The reported harvest (Table 1) assumes that caribou taken in June through to September would be by boat and all-terrain vehicles in Prince Albert Sound area (Dolphin and Union herd). Caribou taken October to May would be northeast and north of Holman and from the Minto Inlet Herd.

Table 1. The reported harvest documented by the Kitikmeot Harvest Studies for 1983-84 to 1986–87 (D'Hont and Croft 1995,) and the Inuvialuit Harvest Study for 1987–88 to 1995-96 (J. Nagy unpubl. data 1998). Harvest information from the Kitikmeot Harvest Studies includes only the harvested caribou for which a location was recorded.

	Minto Inlet	Prince Albert Sound	Total
1983–84	931	172	1103
1984–85	247	134	381
1985–86	836	154	990
1986–87	757	76	833
1987–88	600	44	644
1988–89	405	110	515
1989–90	420	189	609
1990–91	329	222	551
1991–92	192	308	500
1992–93	155[1]	202	357
1993–94	0	351	351
1994–95	7	277	277
1995–96	0	381	381

[1] Holman self–imposed a ban on hunting caribou on northwest Victoria Island in April 1993.

The harvest information suggests that during the 1980s the annual harvests were between 4 and 16% of the 1980 estimated herd size (247–931/6000 based on 30% visibility correction) but by 1987, 17% of the 1987 herd estimate (3500). The level of annual harvest dropped by 1992, but the relative proportion of the estimated number of caribou being harvested had increased to 28% (192/680 based on Heard's (1992) comment that the caribou densities were possibly underestimated fourfold).

Wolf predation and disease:

Attributing a decline in large herbivores to wolf predation is difficult without information on predator numbers and predation rates. Plainly, wolves eat caribou and we can abstract all manner of scenarios where so many wolves eat so many caribou. For example, Miller (1995) extrapolated from known kill rates and wolf requirements to

allocate an average of 11 ungulates per year per wolf. Miller (1995) believed that over the long term, annual kill rates of >10% of an unhunted population of Peary caribou would not be sustainable.

Wolves have increased (Appendix D) possibly in responses to the increases in the number of caribou and muskoxen during the 1970s. However, we do not know the effect of changes in trapping of foxes and travel on the land during the same period, both of which may have also benefited the wolves.

In the absence of numerical data on the rate of decline, the numbers of wolves and the extent that they take other prey, we can say little about the role of wolves in the decline of the caribou. While the potential for wolves to have driven or accelerated the decline must be acknowledged, there are insufficient data to justify or measure the effects of management action such as the removal of wolves.

We can discount disease on the assumption that hunters would have reported diseased caribou. Collections of caribou on southern Victoria Island (Gunn *et al* 1991) and the High Arctic Islands (Thomas and Broughton 1978) identified no serious diseases and no evidence to anticipate any epidemics.

Weather:
We have no direct evidence for the effect of severe winters on the caribou on northwest Victoria Island: no die-offs due to weather have been described as has been the case in other areas on the High Arctic Islands and Banks Island (Parker *et al.* 1975, Morrison

1978). Nonetheless, at the Wildlife Management Advisory Committee meeting in September 1990, Holman HTC requested a study of caribou killed due to severe winter weather conditions at Minto Inlet. A survey was started but the helicopter broke down and Buddy Alikamik and Laurie Buckland only found the carcasses of a wolf–killed or scavenged caribou calf and old bull in August 1991.

Annual snow depths recorded at Holman reached the levels associated with those die-offs elsewhere only in the early 1960s and 1992/93. It should be noted however, that no weather information was collected in the 1970s and there are gaps in the records for more recent years. More records are available for early winter (September, October and November) than total, mid or late winter. The trend in the 1980s was toward higher snowfall compared to the 1960s, at which time hunters reported that the caribou were increasing and annual snowfall was decreasing.

We know relatively little about the interactions between caribou, weather and forage. We know that caribou preferentially feed on the plants of drier sites (Parker 1978, Parker and Ross 1976, Shank *et al.* 1978) and that as moisture is a limiting factor summer rainfall will influence plant productivity (Svoboda 1977). Caribou also preferentially forage on the flowers of several species. The amount of flowering depends on the temperature of the preceding summer. We do not, however, have measures of how changes in summer precipitation and temperature affect the caribou's ability to replenish their body reserves and support the growth of their calves. We have little understanding of the more subtle effects of the annual variations in snowfall,

accumulation, and other conditions such as freezing rain on forage availability and caribou physical condition.

We have argued that caribou live in a 'non-equilibrium grazing system' where sporadic, unpredictable abiotic variables (i.e., snow and ice) usually govern the fate of the caribou over time (e.g., Caughley and Gunn, 1993; Behinke, 2000). We suggest that weather is the over-riding influence that sets the stage for other factors including hunting and predation. However, gaps in our knowledge remain, especially the relationship between variations in weather, plant growth and plant responses to herbivore grazing.

Range abandonment:

Abandonment of annual versus seasonal ranges has been occasionally speculated about but not demonstrated for caribou. However, hunters and biologists frequently report variability in use of winter ranges. Particularly severe conditions such as deep snow and icing have been associated with unusual movements such as have been reported from Banks Island (McEwen 1952a; 1952b) and elsewhere on the arctic islands (Miller 1990). While the exceptionally high snowfall in the 1992/93 winter could have triggered a movement to previously unused area, this would not explain why hunters experienced difficulty in finding caribou during the 1991-92 winter.

Abandonment of calving areas or summer range would be unexpected (Gunn and Miller 1986). For this reason, the June 1993 aerial survey area was selected to cover the calving and summer range determined by the 1987–89 satellite telemetry. The low abundance of caribou across the calving and summer ranges in 1993 indicates either a

population decline, an exceptional movement, that the satellite telemetry for 1987–1989 involving only three cows was inadequate to define the annual range, or some combination of these. The movements of the satellite–collared cows 1987–89 are similar to the distribution in August 1980 (Jakimchuk and Carruthers 1980) and previous reports of caribou calving north of Minto Inlet (Jakimchuk and Carruthers 1980), both of which suggest persistence in calving and summer ranges. There were no unusual conditions or disturbances that could cause caribou to abandon their calving and summer ranges.

Oil and gas exploration activity and mining have been minor in the area and then only during the 1970s. Hunters from Holman did not identify industrial disturbance as a factor for any unusual movements of caribou. On other arctic islands hunters have associated exploration with unusual movements of caribou (Freeman 1975).

Elder hunters refer to the movements of caribou between Banks Island and Victoria Island (Appendix A). Although no evidence was found for springtime crossings in 1986 (Miller 1986) this would not rule out crossings perhaps when caribou were more abundant. The caribou on Banks Island declined from 9,000 in 1972 to about 1,200 in 1992 (McLean and Fraser 1989, McLean *et al.* 1986, J. Nagy pers. comm.). The decline on Banks Island lessens the likelihood that caribou from Minto Inlet have moved to Banks Island, although this cannot be ruled out either.

Some hunters (Appendix A) suggested that the caribou from Minto Inlet have moved southeast to Cambridge Bay and the mainland. However, hunters at Cambridge Bay had not reported seeing the smaller–bodied Minto Inlet herd caribou. In June 1994 Nishi and Buckland found calving cows north of the Kuujjua River in the Shaler Mountains and as a result raised the question of whether the Minto Inlet herd had shifted their calving grounds to the east (Nishi and Buckland, 2000). The June 1993 survey did not cover the Shaler Mountains. Nishi and Buckland (2000) also suggested that an alternative explanation to the Minto Inlet herd shifting its calving grounds was that the calving observed in the Shaler Mountains was Dolphin and Union calving which had extended further north than revealed by the satellite telemetry 1987–89.

Support for Dolphin and Union range expansion comes from the movements of satellite-collared cows. In the late 1980s, although one satellite–collared cow from the Dolphin and Union herd reached the Kuujjua River during her postcalving migration, none crossed to the Shaler Mountains (Gunn and Fournier 2000). However, on 20–21 July 1996, four cows were fitted with satellite–collars in the Shaler Mountains (Appendix E). The purpose of this project was to describe the movements of caribou in the Shaler Mountains in response to community concerns about proposed mining exploration. Those four cows migrated to the south coast of Victoria Island during September and either wintered along the south coast of Victoria Island (one cow) or on the mainland. The only cow either alive or with a functioning collar in 1997 returned to the Shaler Mountains during postcalving migration.

Competition with muskoxen:

The argument to relate the decline in caribou to increasing numbers of muskoxen was not supported by elders in Holman (Appendix A), and some of them believed muskoxen and caribou could live together. A few hunters suggested that there were too many muskoxen. Holman people are long established in the area and have seen fluctuations in both caribou and muskox numbers within living memory. Muskox and caribou numbers had both increased between the 1960s and the 1980s when caribou, but not muskoxen, started to decline. A few people in Holman suggested that the caribou had moved toward Cambridge Bay to escape the muskoxen at Minto Inlet. However, there are as many muskoxen around Cambridge Bay and the movements toward Cambridge Bay are part of the annual cycle of the caribou of the Dolphin and Union herd.

A possible consequence of the higher muskox numbers is that they are alternative prey for wolves and maintain high numbers of wolves even while caribou are declining. Potentially, this could lead to relatively high predation on the remaining caribou or slow their future recovery.

SUMMARY FOR CAUSES OF THE DECLINE

The harvest of caribou was at a level where it was up to 17% of the estimated population, which likely caused a decline in the early to mid-1980s. Added to any other source of mortality, the harvest would have had an accelerating effect in the last few years. Eight of 10 elders interviewed in March 1993 suggested that over-hunting caused the decline of the caribou.

The role of predation by wolves is unknown but the number of wolves increased during the time when the caribou were declining. It is reasonable to assume that wolf predation was also a factor in the decline. It is unknown if a trend of increasing snowfall in the 1980s and early 1990s contributed to the changes in caribou abundance.

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Many people have helped with the surveys but one constant factor was the unflagging support from Kitikmeot Regional staff. Thanks go to Renewable Resource Officers notably Joe Kunyuna and Ron Morrison especially for the way they pitched in and helped in 1993. Perhaps, less tangibly, but whose ready support has been made all the difference are Millie Hikok, Todd Roche, John Stevenson and Gary Weber who, in 1993, were the Coppermine Renewable Resources office. A unifying factor for all the aerial surveys (1987-1993) has been the flying of Nahanni Air Services and Northwright Air Services. The safe flying of pilots Perry Linton and Warren Wright is warmly acknowledged, as is their companionship. In Holman, Jerry Akiahion, Winnie Akhiatak, Gary Bristowe, Agnes Egotak, Patsy and Jean Epakohak, Albert Elias and Allan Sim have often gone out of their way to help and that is much appreciated.

In Yellowknife, Renewable Resources Librarian Alison Welch willingly tracked down recalcitrant references. Judy Williams and Bonnie Fournier with unflappable patience helped with this report in 1993 and again in 2003. John Nagy reviewed the report and his comments are appreciated.

PERSONAL COMMUNICATIONS

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APPENDIX A. Survey of elder's traditional knowledge of caribou in the Holman area (compiled by Albert Elias, June 1993).

Alex Banksland
Born around Bailey Island area between 1925 and 1930. Alex grew up and lived in Holman up to now.

Peary caribou movements (seasonal) seem to be more regular when they are on Victoria Island. Migrate north to calf in the spring and south to winter feeding grounds. Numbers would vary from year to year. He believes caribou move away when there has been a freezing on the ground. Some winters many caribou are seen migrating between Victoria and Banks Islands.

Alex knows there are two different kinds of caribou on Victoria Island, the Peary and the mainland. There is difference in size, colour and taste. Mainland caribou have their young north inland of Prince Albert Sound (P.A.S.) in the summer and winter around P.A.S. and east or south.

Mr. Banksland does not think the Peary caribou have "disappeared" in the last few years. He says it is because of heavy hunting, careless and wastage. Snowmachines make it easier to travel long ways in a short time and it is easier to kill and carry more.

Mr. Banksland also believes that musk-oxen and caribou do not compete for food and habitat and can be seen in close proximity with each other.

In order to try and help the Peary caribou increase, special conservation measures must be taken such as:

1. Impose no hunting north of Minto Inlet.
2. Renewable Resources continue ongoing monitoring and research.
3. Encourage and educate youth about conservation of wildlife and habitat as per the Inuvik final Agreement principles.
4. When summer hunting in P.A.S. cows with fawns not be taken, take only young males and no wastage. Perhaps wildlife officer should be patrolling and enforcing.

Jimmy Kudlak
Born and raised in Prince Albert Sound (P.A.S.) and later moved to Holman.

Seasonal movements in the P.A.S. area were and still are the caribou travel north inland to have their young and late in the fall migrate south and further east. Jimmy remembers no caribou at P.A.S. during the 1940s. Some believe it was because when high-powered rifles were introduced there was over killing of caribou for their skins. Long ago Inuit only hunted what they need for food and clothing, supplemented with seal meat and fish. Jimmy agrees there are two distinct species of caribou on Victoria Island.

Peary caribou migrated from Banks Island in the early 1960s and seem to thrive on Victoria Island.

He thinks the Peary caribou were hunted too heavily while they were plentiful around Holman area. Careless hunting and wastage has been a big factor in declining numbers. People population increase resulting more hunters with machines and high-powered rifles. Caribou never really run away from snowmachines, too fast, caribou just stop and wait.

No comment on relationship between caribou and musk-ox.

Conservation and protection of caribou:
Jimmy suggests a quota be imposed on Peary caribou. Limited take of caribou at P.A.S. summer hunt 2 or 3 per boat.
Cows with young not be taken at all. Presence of game officer to enforce would help.

Sam Oliktoak
Sam believes mainland caribou have migrated south eastward at the present time. He knows Peary caribou move back and forth between Banks and Victoria Island. Mainland caribou in the Prince Albert Sound move north to calve in the spring then travel in the fall back to the coast. This caribou is the same herd that goes to Read Island and east to Cambridge Bay.

Mr. Oliktoak knows there are two kinds of caribou in Victoria Island.

Sam acknowledges that the Peary caribou have declined drastically in the last few years. Long ago they would be gone for some time but always return. But he is very concerned with the present decline and conservation measures must be taken by the H.T.C. with the help of Renewable Resources.

Hunters must be made aware of the seriousness of the situation.

Efforts must be made to educate people about conservation. Human population increasing and hunting only one area causes decline.
Temporary quota should be agreed to by all parties.

Use of musk-ox and seal should also be encouraged.

Frank Kuptana
Born in the Minto Inlet area. Frank was adopted as a child and grew up in the mainland close to Coppermine. In those days the Inuit hunted caribou with bows and arrows and spears. The animals were usually herded to a water body and using kayaks were killed as they swam. This type of hunting required even women and as a co-operative effort it made hunting easier. He remembers this was done with conservation in mind, not taking more than they can use.

Seasonal movements of both Peary and mainland caribou have always been spring migration inland north to have their young and in the fall as winter approached the caribou would normally travel south. Frank knows there are two kinds of caribou on Victoria Island because of their difference in size, colour and taste (meat).

Some years the Peary caribou would cross over to Banks Island and when that happened there would be very few of them on Victoria (north of Minto). Some Inuit from this area would travel to Banks to hunt caribou there. During these times most Inuit would survive largely on seal and fish.

Up until and into the 1960s hunting was done mainly on foot and by dogteam and this way there was no negative impact on wildlife especially caribou. It was when snowmachines were introduced to us that we started noticing a decline in the caribou population (Peary). Meat wastage was evident as a result of careless hunting. Frank believes the Peary caribou are disappearing because of overhunting in a much larger area. He thinks because of the strong odour of musk-oxen the caribou do not like to be near them. He does not believe that to be the cause of their decline. Musk-oxen tend to stay in one area much longer to graze but caribou move along longer distances as they migrate. Frank believes that for the Peary caribou to survive and increase no hunting should be done in the Minto Inlet area. Research and monitoring should be on-going to determine their status. Controlled hunting for mainland caribou in the Prince Albert Sound area is an option.

Jimmy Memogana
Born in 1919, May 14 at Tuktoyaktuk. Moved to Banks and Victoria Island during the 1936-37. Following a heavy snowfall and big rain one fall, musk-oxen and caribou died of starvation as a result. 1957 saw Peary caribou population increase and in 1960 musk-oxen started moving in and gradually increase.

Jimmy knows there are two types of caribou on Victoria Island, Peary around the Minto area and mainland caribou in the Prince Alberta Sound area. Movement patterns are similar on both species being north in spring to calf and south in the fall to graze.

Jimmy thinks people population increase in one settlement such as Holman is the main cause of Peary caribou decline. Hunting competition caused by Inuit coming from

different regions to Holman. Controlled or organized hunting should be done in the Prince Albert Sound and to stop hunting Peary caribou in the Minto area until the population stabilizes again and if hunting is allowed again should be on a limited bases, sustainable harvest to be determined by researchers and local people. A.T.V.s should not be used for caribou hunting only for musk-oxen. Encourage our people to use seal meat as in the past. New hunting bylaws could be enforced by local wildlife officer.

Agnes Goose
Born in Bailey Island, 1925. Daughter of Billy Natkusiak who was the chief guide of Stefansson. The family moved to Holman around 1935-36. There were no caribou those years around Holman but some were north of Minto. Because of long distance of caribou, people would go hunting by dogteam as the daylight got longer.

Agnes agrees there are two different kinds of caribou, Peary and the mainland. The animals to the east are larger, darker, and meat taste is different from the Peary that live north of Holman. Their migration movements are similar, north in spring and summer then south in the fall and winter.

Agnes believes that in order for the more vulnerable Peary caribou to survive hunting restrictions must be put in place by all stakeholders. Renewable Resources and the people of Holman. She says that Peary caribou should be left alone to help it increase. Organized or limited hunting should be encouraged in the Prince Albert Sound area. She also believes that Renewable Resources and Inuit must continue to work together to ensure that any wildlife does not become in danger of depleting. Educating the public and in the schools is important. Ways of living have changed and we must adjust our ways of hunting and fishing so our next generation may continue to use the resources. Hunters' and Trappers' Committees must practice their responsibilities.

Morris Nigiyok
Born in Pemmican Pt., Walker Bay 1934. Lived mostly at Minto and Holman area, spent a few years on Banks Island. Morris knows there are two distinct herds on Victoria Island. peary being smaller, light colour, and has more tender meat. The mainland caribou that are around Prince Albert Sound are larger, darker and has a different taste in the meat.

Morris says the Peary caribou after freeze-up moved south even as far as the mainland. He thinks that is the reason for the decline. Morris also believes that musk-oxen and caribou can live close together, just graze on different vegetation.

Peary caribou cross between Banks and Victoria Island.

Heavy hunting pressure is main factor in Peary caribou decline. Wolf predation not a significant factor.
Morris was reluctant to say what should be done to save the Peary caribou.

Harry Egotak

Born October 10, 1924 on Banks Island and raised up at Prince Albert Sound.

He remembers his parents hunting caribou inland on foot around Tahiryoak, fishing at the same time. Meat would be cached and stored until winter and the skins were used for winter clothing. After freeze-up they would hunt seal for the winter. When there was freezing rain in the fall, the caribou would move away to better grazing land. Because Victoria is a huge island, the animals have no problem finding ice-free vegetation.

Migration patterns of both species of caribou are same, further north inland in the summer and south in the fall. Having lived in the Prince Albert and Minto area all his life, Harry knows there are two different herds of caribou. Larger, darker ones range in the Prince Albert Sound area and the smaller, whiter Peary in the Holman and Minto Inlet and Walker Bay country.

During 1950s were not many caribou around Minto. In the 1960s Harry settled in Holman and noticed Peary caribou gradually increasing north and south of Minto Inlet. Caribou on Banks have declined drastically in the last few years and now that same herd is doing the same thing here on Victoria. Human population increase required more meat. Over hunting the resource. A.T.V.s and snowmachines make hunting easier and faster.

Harry thinks some Peary caribou may have moved to the mainland but thinks the numbers are small. When he thinks of long term protection of both species, Harry says restrictions should be put in place by the users. Suggests no hunting north and east of Minto until population stabilizes. Even after that taking of Peary caribou should be made with conservation in mind.

Limited hunting should also be encouraged in the Prince Albert Sound area (summer).

William Kagyut
Born at Kuuk River, Prince Albert Sound 1922.

William remembers Inuit hunted caribou in that area during the summer and winter. He was raised up and learned to hunt while at Prince Albert Sound.

In the 1930s William hunted and trapped in the Holman area. He noticed that Peary caribou migrated between Banks and Victoria Islands and believes that some may have drowned. He also knows there are two kinds of caribou, Peary caribou live mainly in the Minto Inlet and north while the larger, darker animals range in the Prince Albert Sound country. Both species have similar migration patterns in their respective areas.

William believes people take too much Peary caribou especially when snowmobiles were introduced to the north. Long ago one had to be a skillful hunter using dogteams. Fast snowmobiles makes hunting very easy, does not require much skill.

Nickolas Aloakyuk

Born Prince Albert Sound Ivitalik 1923 March-April. Grew up in and around Minto Inlet.

Remembers first during summer families would move inland in search of caribou for food and clothing. No wastage of meat, make dry-meat.

Nick's father told him that years ago when high powered rifles were introduced to the area, caribou were slaughtered in great numbers for their skins, a lot of meat wastage. These caribou were likely mainland caribou, which are bigger than the Peary caribou.

When they lived around Berkely, many Peary caribou can be seen crossing from Banks Island.

Knows that there are two kinds of caribou, Peary caribou and mainland caribou (latter from east). During 1950s he thinks Peary caribou never really declined as they do now.

Mid 1960s there was a wet fall and snow froze over and the Peary caribou disappeared or moved away.

Decline? (cause) easy hunting by snowmachines, careless hunting, wastage, garbage on land.

Relationship between musk-oxen and caribou can stay in same area without disturbance as they feed on different vegetation. Caribou and musk-oxen can be seen in close proximity when hunting.

Nickolas believes people should be encouraged to eat seal meat and musk-oxen.

He suggests Peary caribou should be not hunted for some time and closely monitored and enforced.

Caribou hunting should only be allowed in Prince Albert Sound.

Elders and young people must co-operate and communicate and educate each other regarding conservation.

APPENDIX B. Aerial surveys to delimit caribou calving areas north of Minto Inlet, northwest Victoria Island, in March 1993.

INTRODUCTION

The hunters of Holman had reported difficulty in finding caribou while hunting around Minto Inlet in the winters of 1991/92 and 1992/93. In response to those concerns and to evaluate muskox distribution in relation to a commercial harvest, an aerial survey was planned for March 1992 (Heard 1993). From sightings of only 26 caribou in 8 groups, Heard (1993) estimated that there were 170 ± 54 caribou from the north side of Prince Albert Sound north almost to the latitude of Dean Dundas Bay. Mt. Phayre and Walker Bay were missed although caribou have been frequently found there in winter.

The low numbers of caribou estimated in March 1992 and the continued difficulties of the hunters in finding caribou led to another survey in March 1993. The objectives of the survey were to estimate caribou abundance and distribution

METHODS

The survey aircraft was a Helio-Courier on skies and the methods were almost identical to the June 1987 and 1993 surveys (Appendix C). The transect width was 0.75 km on either side of the aircraft. We checked the markers by flying at survey altitude over the runway lights and runway end markers on the Holman airstrip. When flying along the transects, the aircraft altitude was 150 m agl. The airspeed was 160 km/h.

RESULTS

We counted 11 caribou on 1,988 km of transect on northwest Victoria Island on 18-20 March 1993 (Table B.1). The survey coverage was 10% for Stratum I. We decreased the intensity of coverage to 5% by dropping alternate lines for transects 15 - 22 (strata II). This allowed us to add a third stratum west of Glenelg Bay (Stratum III) so as to increase the geographic coverage. We calculated an estimate of 114 ± 22 (S.E.) caribou but the estimate is imprecise as the coefficient of variation is 19% (Table B.2).

The weather during the survey (18 and 20 March 1993) was clear with scattered patches of ice-fog. Winds were light in temperatures of -36°C. A blizzard developed on evening of the 18 March and had abated by midday but ice fog and turbulence led to abandonment of Transect 15. Instead we flew low level reconnaissance along the northwest coast but found no tracks or feeding craters.

Table B.1. Caribou observed on transect during an aerial survey **of northwest Victoria Island, N.W.T., March 1993.**

Transect No.	Transect Area (km^2)	Caribou (+ calves) on transect	Caribou off transect
Stratum I			
1	37.5	1	0
2	39.0	0	0
3	44.5	0	0
4	56.0	0	2
5	67.5	0	0
6	60.0	0	0
7	66.5	0	0
8	63.5	0	0
9	59.0	2	0
10	56.0	2	0
11	54.5	0	0
12	51.0	0	0
13	50.0	0	0
14	56.5	1	0
15	57.5	0	0
Total	883.0	7	2
Stratum II			
17	55.5	0	0
19	62.0	0	0
21	56.5	5	0
22	56.0	0	0
Total	230.0	5	0
Stratum III			
23	34.3	0	0
24	24.3	0	0
25	42.0	0	0
26	93.8	0	0
Total	194.4	0	0

Table B.2. Analysis of data from the transect survey of caribou on northwest Victoria Island, N.W.T., March 1993.

Maximum number of transects	(N)	102
Number of transects surveyed	(n)	15
Stratum area, km	(Z)	12,890
Transect area, km	(z)	1,325
Number of caribou counted	(y)	12
Caribou density, Caribou/km	(R)	0.009
Population estimate	(Y)	114
Population variance	(Var,Y)	470
Standard error	(SE,Y)	22
Coefficient of variation	(CV)	0.92

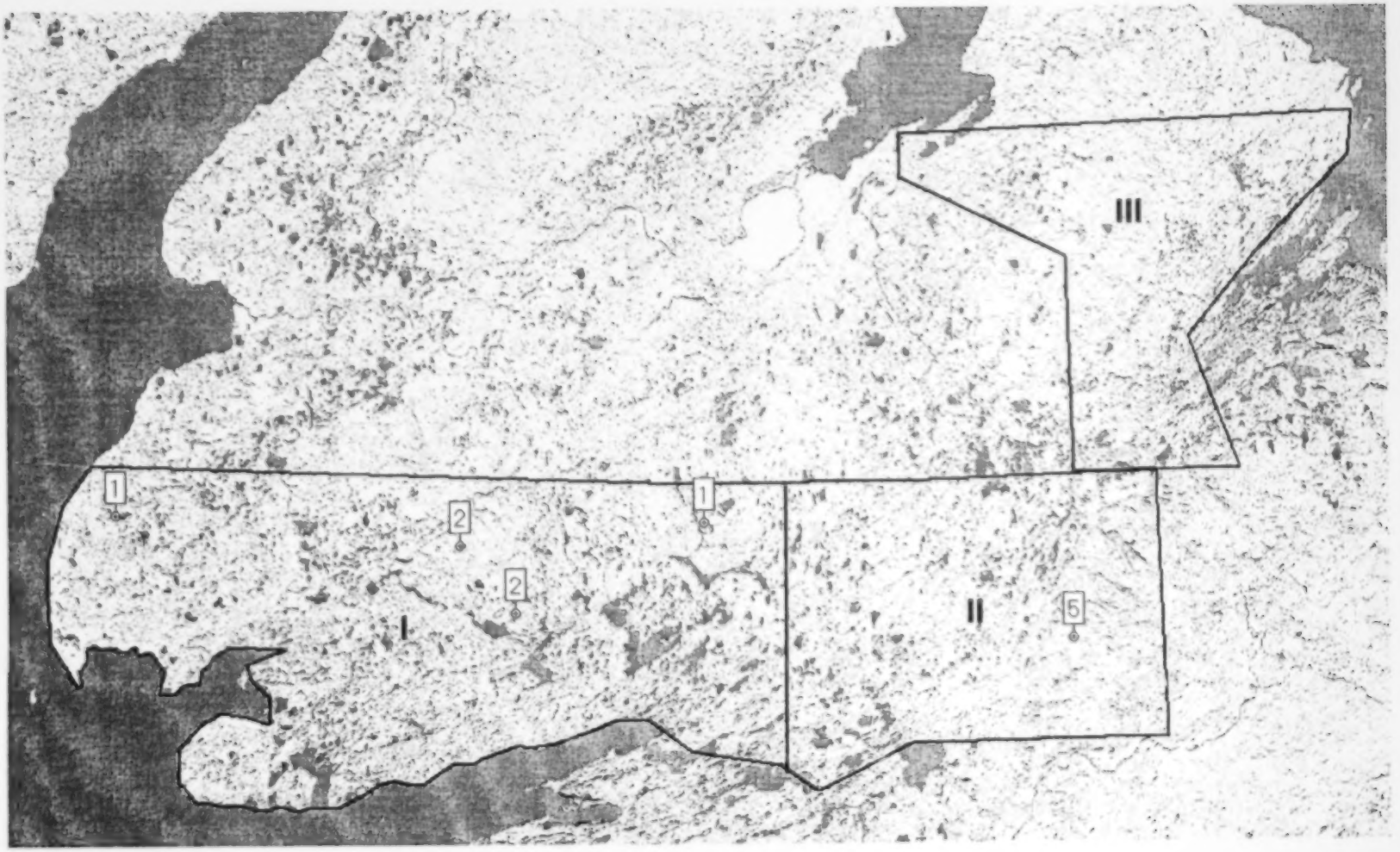

Figure B 1. Strata and caribou sightings on northwest Victoria Island March 1993.

APPENDIX C. Aerial surveys to describe caribou abundance and distribution north of Minto Inlet, northwest Victoria Island, in June 1993.

INTRODUCTION

The objective of the survey was to determine caribou abundance and distribution during calving but to include the known annual range based on the 1987–89 satellite telemetry (Gunn and Fournier 2000).

METHODS

The survey aircraft was a Helio-Courier on skies. The survey crew was a right and left observer both seated in the rear and the pilot who navigated and plotted observation numbers on 1:250,000 scale topographic maps. The left observer recorded the sightings for both observers by location number in a field notebook.

A wire was stretched from an eyebolt on the wing to the fuselage (the Helio-Courier does not have wing struts). Boundaries for the inside and outside of the transect were calculated (Norton-Griffiths 1978) and marked by red tape on the wires and windows. The transect width was 0.5 km on either side of the aircraft. We checked the markers by flying at survey altitude over the runway lights and runway end markers on the Holman airstrip. When flying along the transects, the aircraft altitude was 150 m agl. The airspeed was 160 km/h.

RESULTS

We counted 15 caribou and 1 calf on 2114 km of transects and 5 caribou off transect on 13 - 15 June 1993 (Table C.1, Figure C.1). The coverage was 16%. The caribou on Prince Albert Peninsula were a cluster of four groups including a cow-calf pair near the coast north of Dean Dundas Bay (a cow with hard antlers and with a yearling; 3 cows with no antlers; and 4 cows with no antlers). The other groups were 3 cows at the northern end of Prince Albert Peninsula, a cow with hard antlers and a yearling on the coast south of Dean Dundas Bay and a cow (no antlers with a yearling midway between Dean Dundas Bay and the Shaler Mountains.

The 3 days of the survey were generally cloudy with fog preventing the completion of the east 20-30 km of transects 2 and 3. The background for observing the caribou varied with elevation: the lower elevations had patchy snow and the high elevations had up to 90% snowcover. Tracks identified as caribou were sporadic and scattered with no concentration of trails. The observers classified the caribou on the basis of antlerless (assumed to be cows which had calved) cows and cows with hard antlers and yearlings or newborn calves. No large bulls were seen.

Table C.1. Caribou observed on transect during an aerial survey of northwest Victoria Island, N.W.T., June 1993.

Transect No.	Transect Area (km^2)	Caribou (+ calves) on transect	Caribou off transect
1	168.5	2	0
2	160.0	0	0
3	155.0	0	0
4	137.5	0	0
5	140.0	0	0
6	152.0	0	0
7	147.5	0	0
8	124.0	10 + 1	2
9	118.5	0	0
10	111.0	0	0
11	112.0	0	0
12	99.0	0	0
13	86.5	0	0
14	72.0	0	0
15	48.0	3	3
16	177.5	0	0
17	NOT FLOWN	-	-
18	105.0	0	0
Totals	2114	15 + 1	5

DISCUSSION

We considerably expanded our survey area in June 1993 compared to June 1987. We flew four times the length of transects and covered the annual range of the caribou as determined from the satellite telemetry 1987-88. The increase in the area covered was in recognition that snowfall had been exceptionally high in the 1992/93 winter which may have delayed or prevented the return of the caribou cows to their calving area.

Jakimchuk and Carruthers (1980) had suggested from the summer distribution of caribou on Prince Albert Peninsula and information from people in Holman that a calving area lay in the highlands of that Peninsula. This proved to be the case from our telemetry and surveys in 1987 and 1988 (Gunn and Fournier 2000). But, Miller (1986) observed 72 cows and 23 newborn calves on the interior and intermediate ground in elevation on Prince Albert Peninsula from 28 May to 12 June, 1985 during his study of possible inter-island movements between Banks and Victoria islands. His sightings of concentrations of caribou near Dean Dundas Bay included a high proportion of bulls, juveniles and yearlings. From this Miller (1986) offered three options (1) The cows and calves "missing" from Prince Albert Peninsula had moved to and calved near Jesse Bay, Banks Island (where Miller had seen a concentration of cows and newborn calves in June 1985) (2) The calving area on Prince Albert Peninsula lay further east of Dean Dundas Bay on the higher ground or (3) The searching effort in June 1985 was not enough to locate the calving area. Our 1987-88 telemetry and surveys suggest that an additional explanation is that Miller (1986) had indeed located the calving areas but the number of caribou was less than he was expecting from Jakimchuk and Carruthers (1980). However, by 1993, either caribou were not calving within their annual range based on 1987-88 satellite telemetry or their abundance had markedly declined.

ACKNOWLEDGEMENTS

Ron Morrison (Renewable Resources, Coppermine) organised the survey and flew with Joe Kunyuna (Renewable Resources, Holman) as the observer and Perry Linton (Northwright Air Services Ltd, Norman Wells) was the pilot.

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gure C. 1. Flightlines and caribou sightings on northwest Victoria Island June 1993.

APPENDIX D. Local knowledge in Holman on wolf numbers, behaviour and distribution, (compiled by Colin Adjun, December 1990)

Colin Adjun interviewed hunters in Holman, December 1990 on their local knowledge of wolves. To structure the interviews, the following questions were asked:

1. Are there more or less wolves then 10-20 years ago?
2. Do they have more or less trouble with the wolves along fox traplines?
3. What size pack are they seeing?
4. What do wolves prefer to feed on Caribou, Muskox, anything else?
5. Where are the wolves usually seen?
6. What colours are the wolves?

John Kuneyuna

1. More wolves now then 10-20 years ago.
2. Last year and few years ago Jimmy Memorana was complaining about wolves on his trapline.
3. This fall there was some wolves tracks lots in one pack but, don't know how many. There were 3 shot this fall at Walker Bay area and two were shot by David just last week.
4. Mainly caribou John said.
5. Northeast of Walker Bay tracks and Prince Albert Sound.
6. Gray and white, 10 years ago John shot two, colours were kind of reddish white.

David Kuptana

1. There are more wolves then 10 years ago.
2. More wolves now bothering traplines in Walker Bay area Jimmy Memorana was trapping them for last few years.
3. 8 were spotted by David Kuptana - Berkley Point there are lots of tracks now.
4. Caribou mostly they don't seem to care too much for muskox.
5. Across Minto Inlet area, near Fish Lake, Glenelg Bay this fall then were right few tracks seen.
6. Gray and white more likely reddish.

Allen Joss

1. There's more wolves now then 10 years ago.
2. Wolves still are a problem with traplines, it would have been more problem if lot of people trap today.
3. Mostly eight in a pack sometimes more but eight or 6 more likely pup family.
4. Wolves mostly eat on caribou.
5. Minto Inlet area, and this summer wolves seen in Kaglokyoak area all summer.

6. Gray & white and reddish colour. If people were still trapping today for sure they would have problems with wolves because wolves are more then 10 years ago. For the last few years nobody hardly trapped.

Roy Inuktalik

Used dogs at that time

1. 20 years ago there were getting to be lots of wolves probably pack of 8 or so, when they find the trapline this use to be a problem stealing foxes from the trapline. When Government did some poisoning in that time in area of west end of Victoria Island and east of Holman it was better then. Now there are more wolves seen, and tracks all over even in east end of Prince Albert Sound.
2. If the people still trap today they would have lots of problems with wolves.
3. Sometimes 8 or 6 in a pack, 1 or 2.
4. Caribou meat mostly.
5. West side of Victoria Island and Walker Bay area.
6. Gray with Reddish colour.

Alex Banksland

1. There are more wolves now then 1964/65 when caribou came then wolves sometimes.
2. 20 years ago, there use to be lots of problems with wolves on the trapline they would go just ahead of a dog team and tear up the foxes.
3. Two or more usually they weren't a problem with traps when they get to know the trapline 6 to 8 but they stay away.
4. Caribou most of the time they eat anything but, caribou mostly.
5. West end of Victoria Island, Walker Bay even to Holman area and west side.
6. Some big wolves usually whitish, females usually kind of reddish and gray.

George Okheena

1. There are more wolves now then twenty years ago. The wolves are growing making pups and more tracks seen each year.
2. Nobody hardly trap now then 20 years ago. But if they were trapping, would be lots of problems.
3. Last week George saw 8 in a pack, got one of them.
4. Caribou
5. Berkley Point and Walker Bay area.
6. Colour usually gray and white reddish some of them.

Patsy Ekpakohak

1. More wolves now then 20 years ago, more tracks and every summer wolves seen.
2. Use to be a problem, eating by wolves 1960 was very bad for wolves. If people still trap today they would have problems.
3. 11 in a pack 1974 8, 6, 4, 5,.
4. Caribou
5. Berkley Point area
6. Gray and whitish.

John Alikamik

1. There were lots of wolves 20 years ago, but poisoning program cut down to few wolves now there are more wolves now because of caribou.
2. Still problems around the traplines. Jimmy Memorana is still having problems. John use to trap few years ago, wolves still bothering trapline.
3. Usually 2, 3, sometimes people see track about 8, 10 wolves in a pack.
4. Mostly caribou sometimes eat fox, but usually just rip and leave it; they usually follow the caribou.
5. Walker Bay, and Prince Albert Sound where there are caribou.
6. Gray and whitish wolves some of them are usually light red.

If the people still trap today would have been a problem with wolves.

APPENDIX E. Satellite telemetry to determine herd identity for caribou summering in the Shaler mountains, Victoria Island, 1996–98 (A. Gunn, J. Nishi, B. Hubert and B. Fournier)

INTRODUCTION

Interest in mineral deposits on Victoria Island has led to increased exploration activity. In 1994, WMC International Ltd. Started consultations with the community of Holman to plan activities on their permitted areas around Prince Albert Sound and in the Shaler Mountains. Holman residents voiced their concern over the possible effects of exploration and mineral sampling activities on Victoria Island caribou; they were concerned about possible disturbance to caribou during the calving and post-calving seasons.

As a result of these concerns and an environmental review of their proposed activities, WMC International Ltd. Agreed to facilitate a study (in partnership with Hubert and Associates Ltd, and the Government of the Northwest Territories) on the movements of Victoria Island caribou close to their field camp and operations base. The study was designed to track the seasonal movements of four caribou cows using satellite telemetry.

METHODS

Study design

The purpose of this study was to monitor the seasonal movements of female caribou on western Victoria Island in relation to areas of interest for mineral exploration. The objectives were:

1. to monitor caribou movements during calving and post-calving to mitigate possible disturbance from mineral exploration and associated activity in the Shaler Mountains.
2. to monitor seasonal movements of Victoria Island caribou that spend summer in the Shaler Mountains.

Data analyses

We received location and activity data from Service Argos and transferred them into a database (Dbase4). Location data was plotted using Spans Explorer 7.1 (TYDAC Research Inc. 1999) software. Satellite data with class codes of A's and B's were not used to map locations because of their inaccuracy.

RESULTS

Capture and collaring

On July 20 and 21 1996, we captured four adult cow caribou within 50 km of the WMC field camp in the Shaler Mountains of Victoria Island (Figure 2). Each cow was fitted with a Telionics ST10 satellite collar. The transmitters in the collars sent a location every five days to an orbiting satellite during most of the year, and every day during calving (May-June).

The transmitter's duty cycles were programmed to transmit 6h on and 18h off between 20 May and 20 June and 6h on and 114h off during the remainder of the year. This normally resulted in receiving location data every 5 days most of the year and every day during the calving period.

One collar (#801) stopped sending location signals in the fall of 1996 near the south coast of Victoria Island and the collar was retrieved from a dead caribou in August of 1997. Collar #5029 stopped sending reliable signals after July 1996 and then resumed functioning from November to December 1996 on central Kent Peninsula. Although this collar kept sending signals through 1998, the position of the collar never changed from central Kent Peninsula and could not be found for retrieval. Collar #119 stopped transmitting the end of June 1997, but the animal's collar could not be located for retrieval. This collar's position remained the same after November 1996. Collar #121 functioned normally through to April 1998 and then did not resume reception until the 30 May. The last reliable location transmitted August 28, 1998.

Seasonal movements

The cows spent most of the summer of 1996 in the area north of the Kuujua River, and then moved south in early fall (Figures 3-6). During the fall breeding season the cows were found along the southern coast of Victoria Island. During freeze-up (late October – early November) three of the collared cows crossed the sea ice to the mainland (Kent Peninsula) (Figures 3,5 and 6). Cow #801 spent the fall and winter of 1996 along the southern coast of Victoria Island.

Only one cow's collar (#121) transmitted reliable location data during 1997. This cow spent the late winter and early spring on Melbourne Island and returned to Victoria Island via Kent Peninsula and the frozen Coronation Gulf by the end of May. She spent the calving period on southwest Victoria Island and then returned to the Shaler Mountains where she was captured in July. She stayed in this area until mid-September and then returned to the south coast of Victoria Island and followed a similar pattern of movement from 1996 to Kent Peninsula and Melbourne Island for the winter of 1997. Satellite reception from this cow's collar was not regular after April 1998. The next reliable location found cow#121 back in the Shaler Mountain area from the end of May until the end of August and then back on Kent Peninsula in December of 1998.

REFERENCES

Nishi, J. and L. Buckland. 2000. An aerial survey of caribou on western Victoria Island (5-17 June 1994). Northwest Territories Department of Resources, Wildlife and Economic Development. File Rep. No. 128. 88pp.

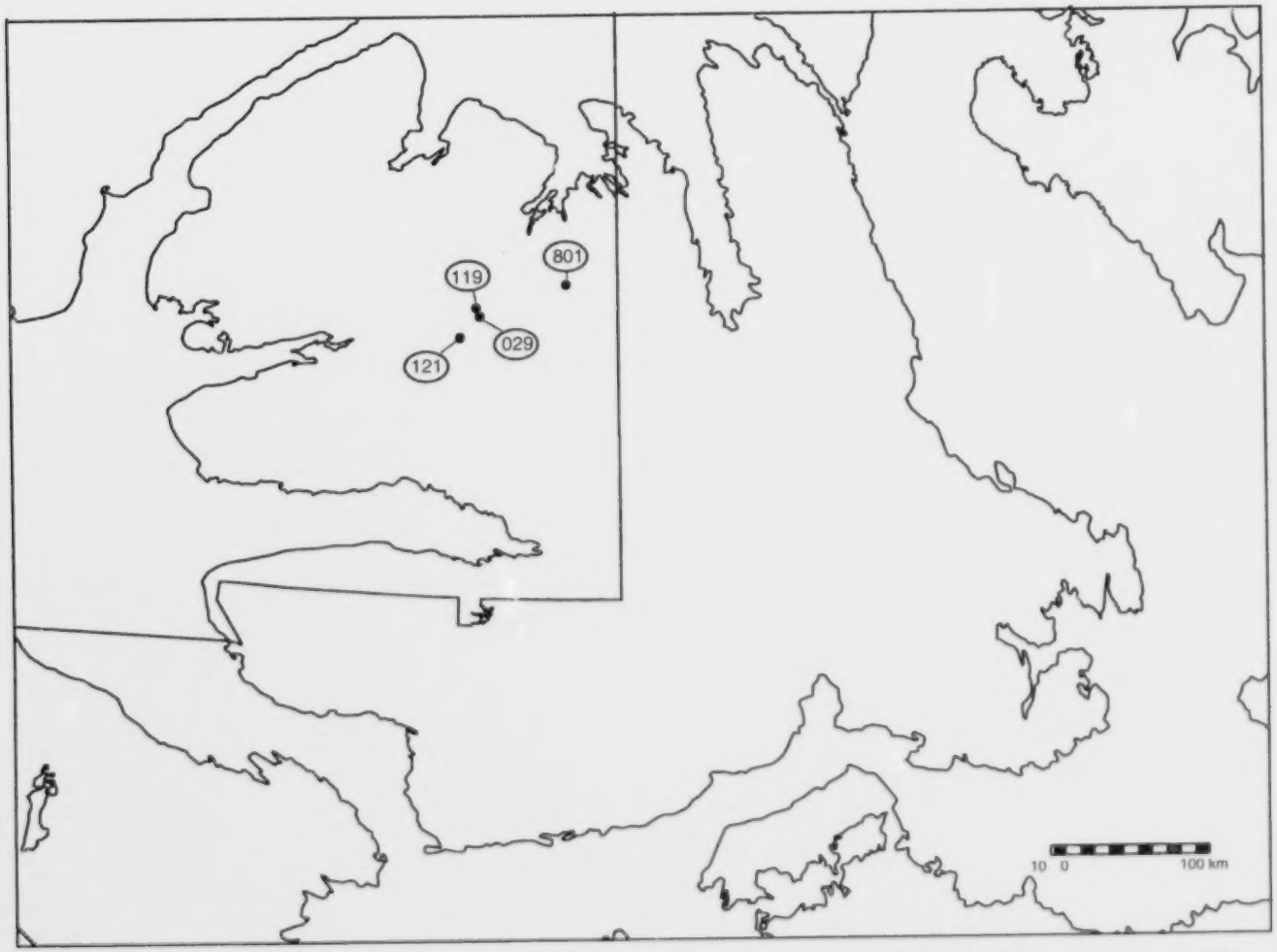

Figure D1. Capture sites of satellite-collared caribou in the Shaler Mountains, NWT, July 20-21, 1996.

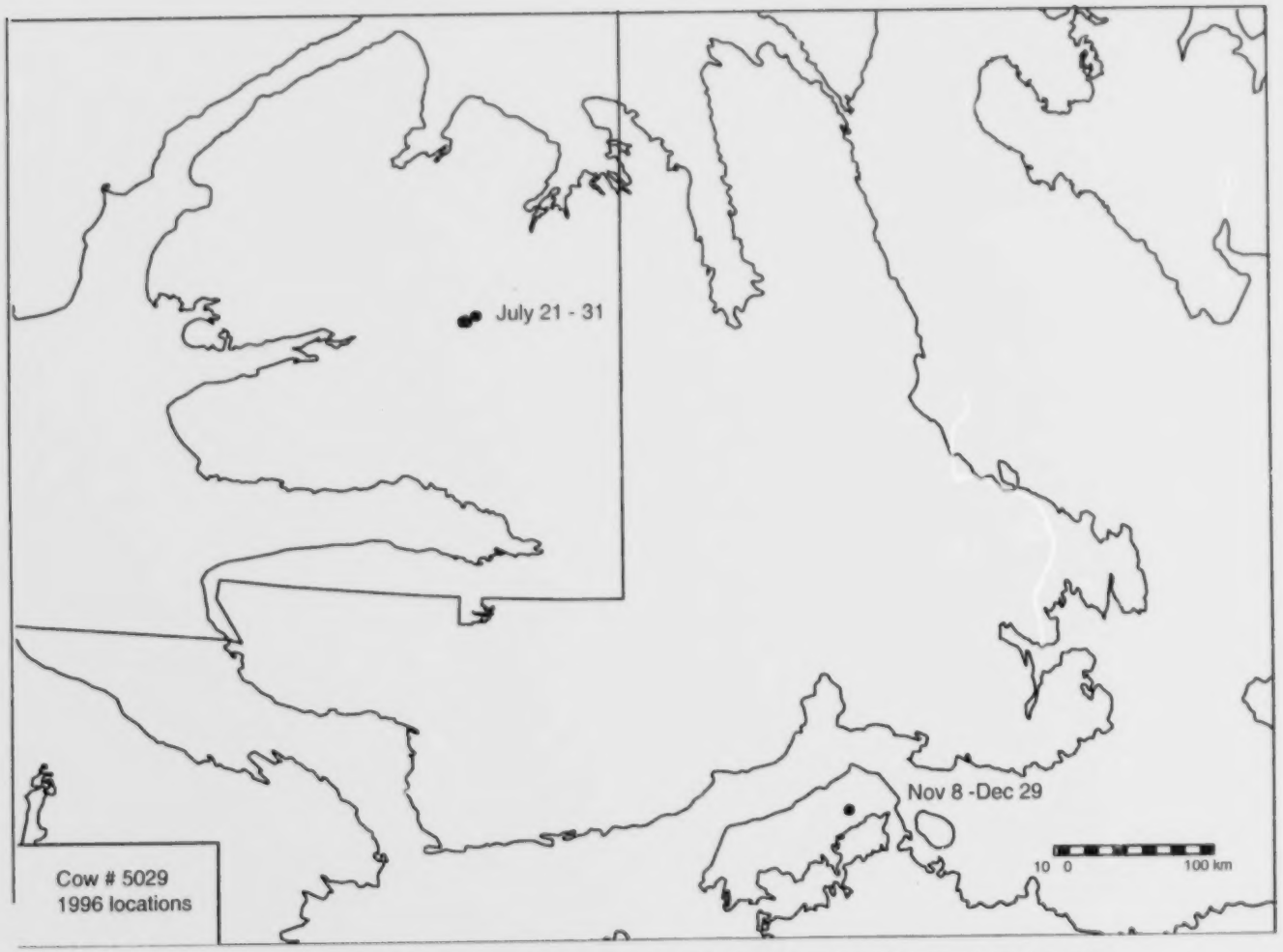

Figure D2. Locations in 1996 for cow #5029 on Victoria Island and Kent Peninsula.

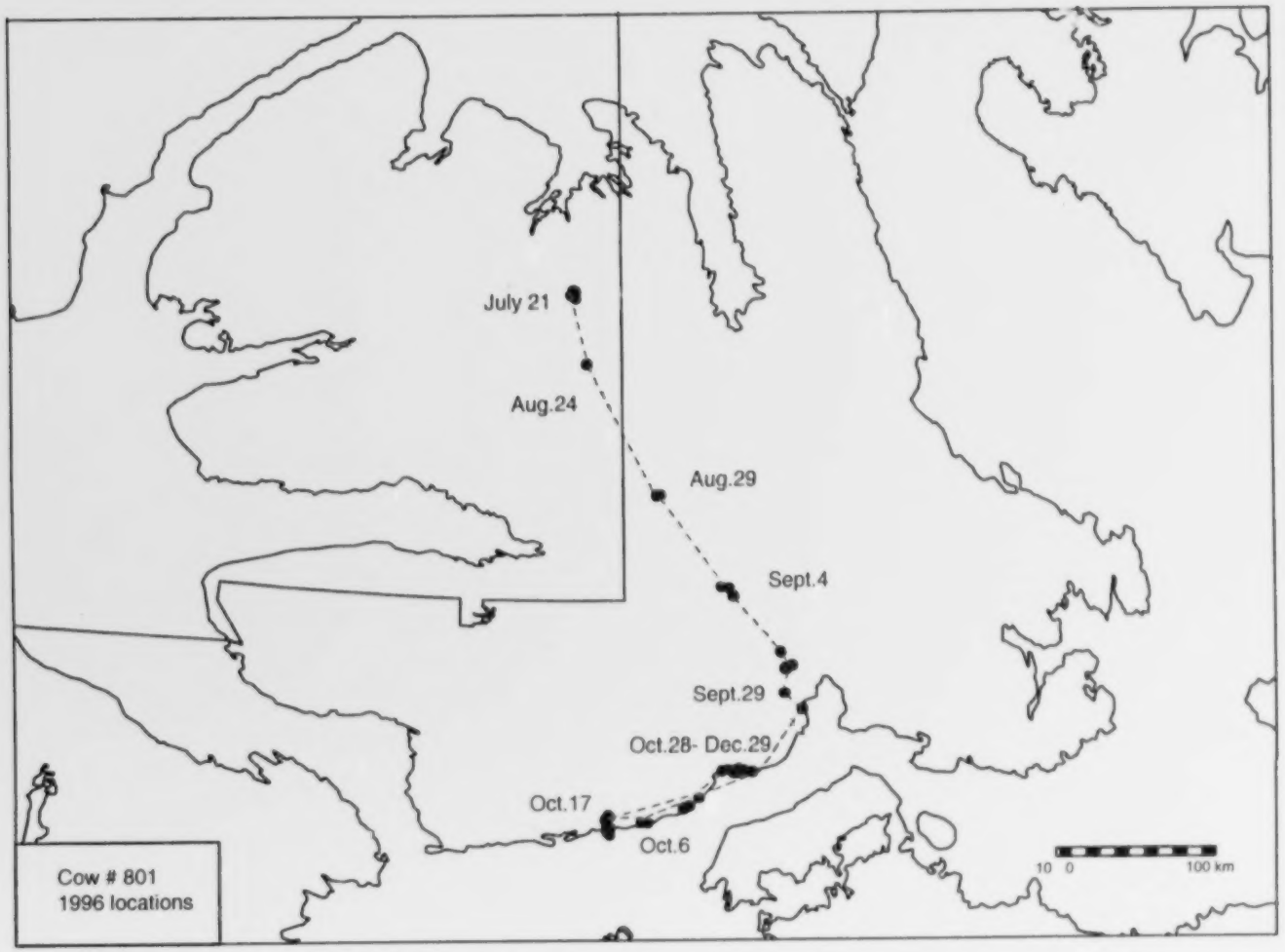

Figure D3. Locations in 1996 for cow #801 on Victoria Island .

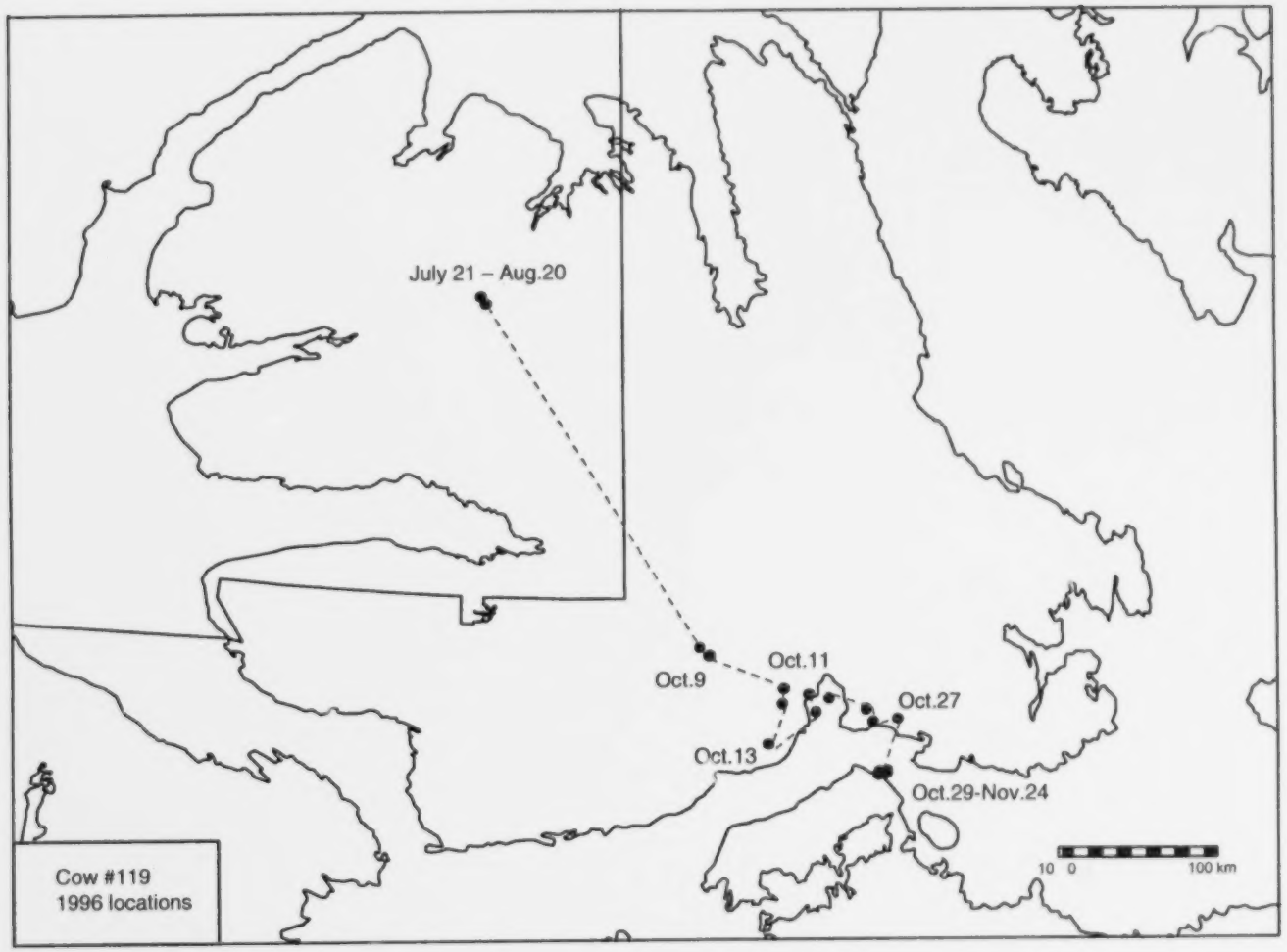

Figure D4. Locations in 1996 for cow #119 on Victoria Island and Kent Peninsula.

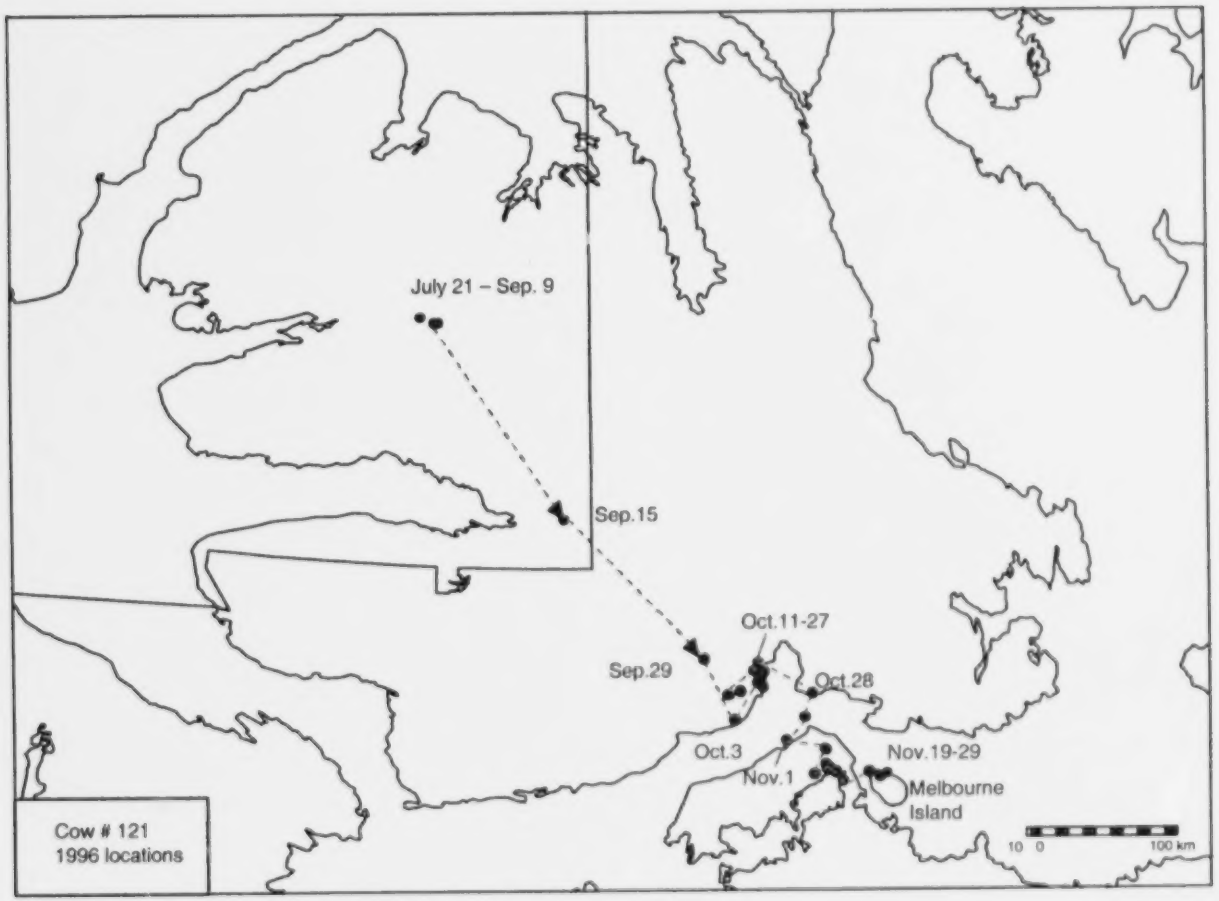

Figure D5. Locations in 1996 for cow #121 on Victoria Island and Kent Peninsula.

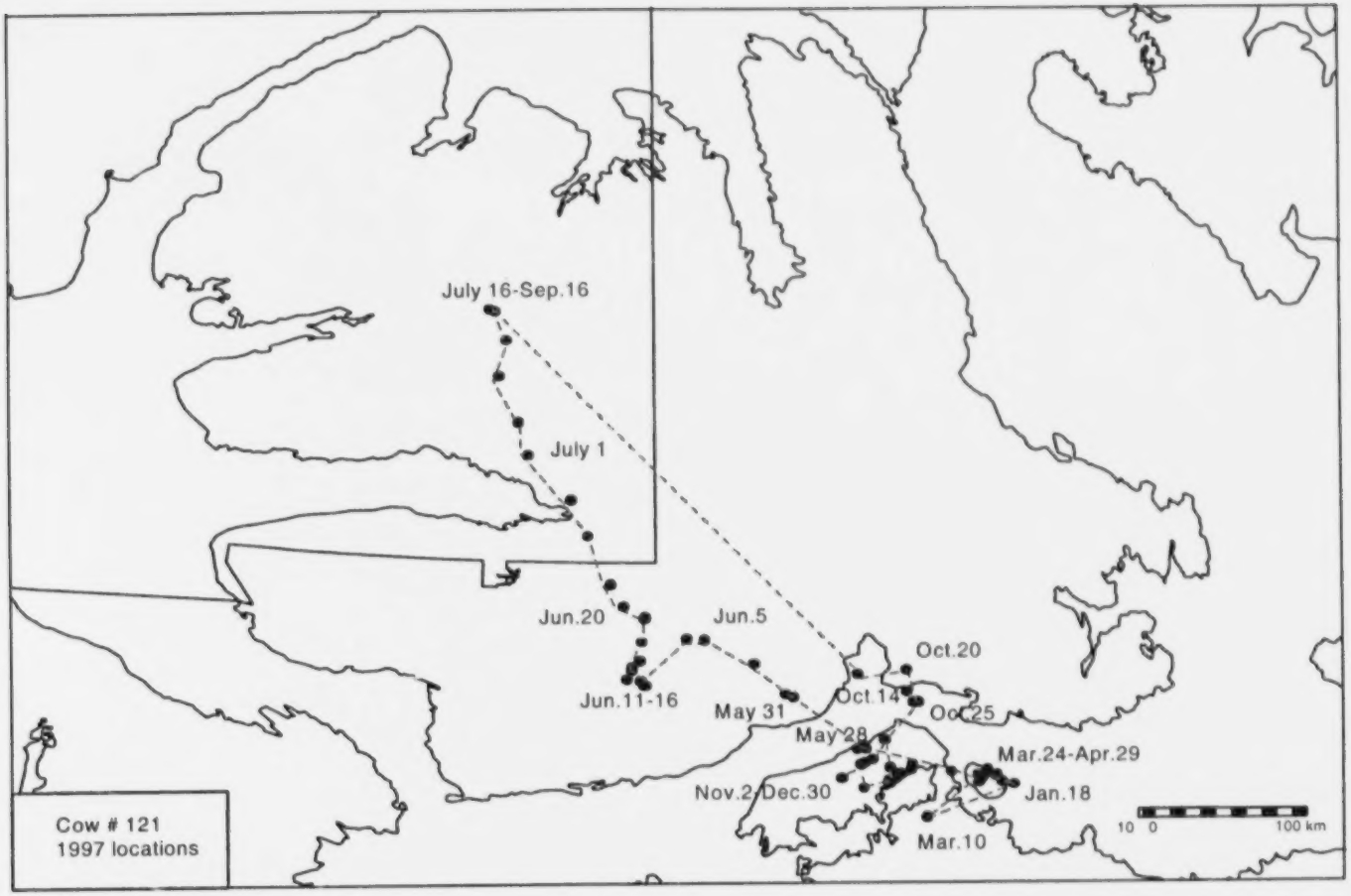

Figure D6. Locations in 1997 for cow #121 on Victoria Island and Kent Peninsula.

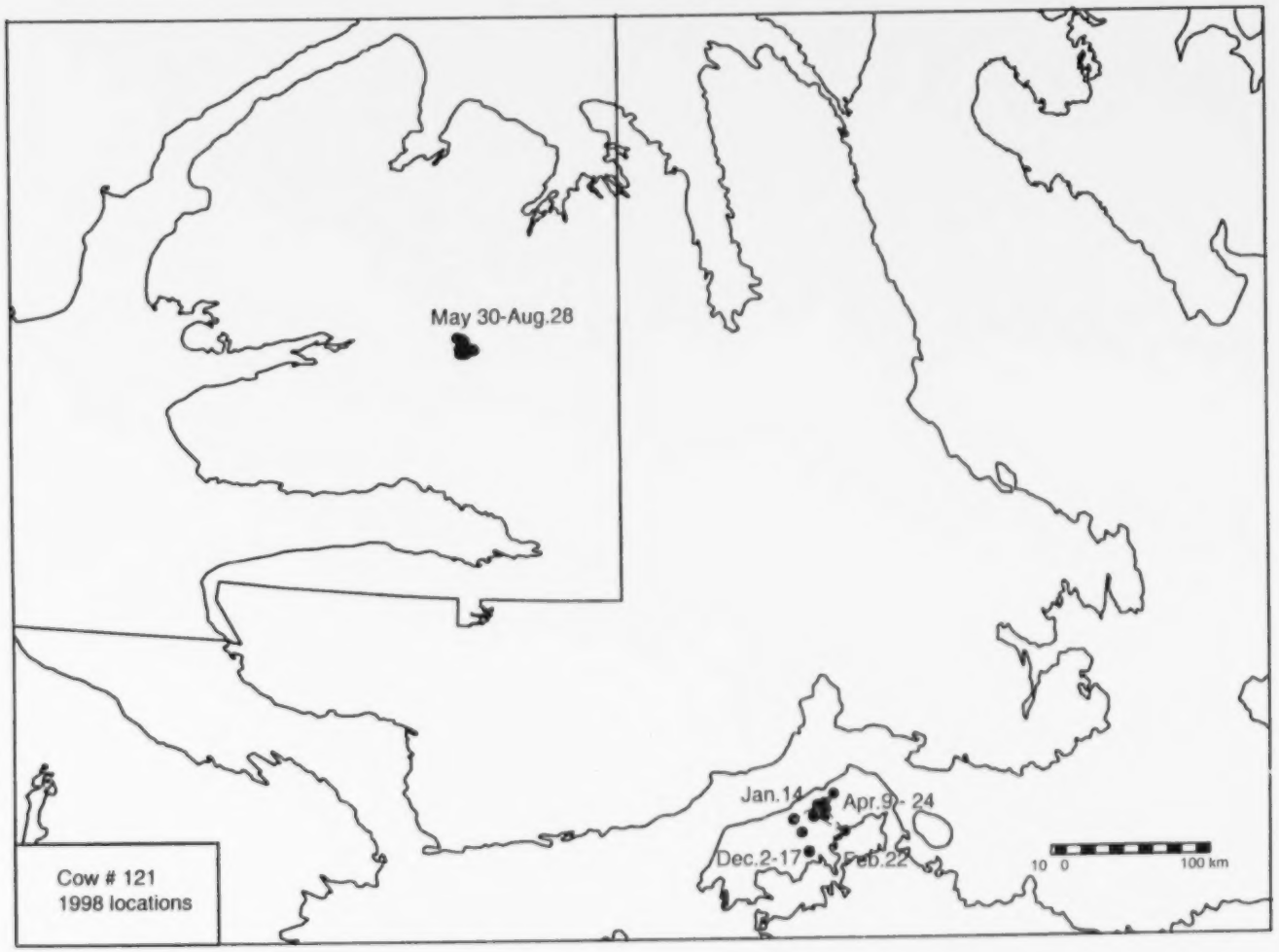

Figure D7. Locations in 1998 for cow #121 on Victoria Island and Kent Peninsula.

Table D1. Satellite location data for Shaler Mountain caribou 1996-1998.

PTT	class	date	Latitude	Longitude
0801	3	7/21/1996	71.90	110.98
0801	2	7/25/1996	71.85	110.92
0801	1	7/30/1996	71.90	110.96
0801	1	8/5/1996	71.87	111.02
0801	1	8/9/1996	71.89	110.93
0801	3	8/14/1996	71.91	111.26
0801	1	8/24/1996	71.45	110.71
0801	2	8/29/1996	70.65	109.45
0801	1	8/30/1996	70.65	109.38
0801	2	9/3/1996	70.07	108.20
0801	3	9/4/1996	70.02	108.13
0801	3	9/8/1996	69.67	107.36
0801	2	9/9/1996	69.66	107.35
0801	2	9/13/1996	69.58	107.17
0801	2	9/19/1996	69.56	107.30
0801	1	9/23/1996	69.57	107.28
0801	3	9/24/1996	69.56	107.27
0801	1	9/28/1996	69.31	107.04
0801	0	9/29/1996	69.41	107.33
0801	2	10/2/1996	68.94	107.93
0801	1	10/3/1996	68.95	108.07
0801	3	10/4/1996	68.79	108.83
0801	2	10/5/1996	68.74	109.00
0801	2	10/6/1996	68.64	109.69
0801	2	10/7/1996	68.65	109.80
0801	2	10/8/1996	68.59	110.34
0801	1	10/10/1996	68.57	110.32
0801	2	10/11/1996	68.61	110.31
0801	1	10/12/1996	68.66	110.39
0801	2	10/13/1996	68.63	110.37
0801	3	10/14/1996	68.67	110.36
0801	2	10/15/1996	68.67	110.36
0801	3	10/16/1996	68.68	110.34
0801	2	10/17/1996	68.68	110.32
0801	2	10/18/1996	68.72	109.10
0801	3	10/19/1996	68.73	109.10
0801	2	10/20/1996	68.95	108.44
0801	2	10/21/1996	68.96	108.34
0801	1	10/22/1996	68.94	108.25
0801	1	10/23/1996	68.95	108.23
0801	3	10/24/1996	68.95	108.21
0801	2	10/26/1996	68.94	108.23

PTT	class	date	Latitude	Longitude
0801	2	10/27/1996	68.96	108.17
0801	2	10/28/1996	68.95	108.23
0801	1	10/30/1996	68.94	108.24
0801	2	10/31/1996	68.95	108.22
0801	2	11/1/1996	68.95	108.24
0801	1	11/2/1996	68.95	108.22
0801	2	11/3/1996	68.95	108.22
0801	1	11/4/1996	68.95	108.24
0801	2	11/5/1996	68.95	108.22
0801	2	11/7/1996	68.94	108.25
0801	3	11/9/1996	68.95	108.23
0801	1	11/10/1996	68.95	108.24
0801	1	11/11/1996	68.94	108.19
0801	2	11/12/1996	68.95	108.25
0801	3	11/13/1996	68.95	108.23
0801	2	11/14/1996	68.95	108.21
0801	2	11/18/1996	68.94	108.23
0801	0	11/19/1996	68.95	108.24
0801	1	11/23/1996	68.95	108.23
0801	1	11/28/1996	68.95	108.24
0801	3	12/3/1996	68.94	108.22
0801	1	12/24/1996	68.95	108.23
0801	2	12/28/1996	68.96	108.21
0801	2	12/29/1996	68.94	108.23
0801	3	2/1/1997	68.95	108.219W
0801	1	2/2/1997	68.95	108.228W
0801	2	2/6/1997	68.95	108.241W
0801	3	2/7/1997	68.95	108.221W
0801	2	2/11/1997	68.95	108.220W
0801	3	2/12/1997	68.95	108.220W
0801	2	2/16/1997	68.95	108.236W
0801	2	2/17/1997	68.95	108.216W
0801	3	2/21/1997	68.95	108.229W
0801	1	2/22/1997	68.95	108.226W
0801	1	2/26/1997	68.94	108.233W
0801	3	3/3/1997	68.95	108.233W
0801	1	3/4/1997	68.95	108.212W
0801	2	3/8/1997	68.95	108.233W
0801	2	3/13/1997	68.94	108.241W
0801	1	3/18/1997	68.95	108.232W
0801	2	3/19/1997	68.95	108.226W
0801	2	3/23/1997	68.95	108.232W
0801	2	3/24/1997	68.95	108.228W
0801	2	3/28/1997	68.94	108.245W
0801	3	3/29/1997	68.95	108.226W

PTT	class	date	Latitude	Longitude
0801	3	4/2/1997	68.95	108.217W
0801	2	4/3/1997	68.95	108.238W
0801	1	4/7/1997	68.95	108.221W
0801	2	4/8/1997	68.95	108.232W
0801	3	4/12/1997	68.95	108.226W
0801	3	4/13/1997	68.95	108.221W
0801	3	4/17/1997	68.94	108.249W
0801	1	4/18/1997	68.94	108.252W
0801	3	4/22/1997	68.94	108.232W
0801	2	4/23/1997	68.94	108.274W
0801	3	4/27/1997	68.95	108.225W
5029	2	7/21/1996	71.68	112.77
5029	0	7/26/1996	71.64	112.94
5029	0	7/27/1996	71.64	113.01
5029	1	7/31/1996	71.65	112.97
5029	2	11/8/1996	68.65	106.35
5029	3	11/10/1996	68.66	106.35
5029	2	11/11/1996	68.65	106.36
5029	3	11/12/1996	68.66	106.34
5029	2	11/13/1996	68.66	106.35
5029	3	11/14/1996	68.66	106.34
5029	3	11/19/1996	68.66	106.34
5029	3	11/24/1996	68.66	106.35
5029	3	11/29/1996	68.66	106.34
5029	3	2/2/1997	68.66	106.35
5029	3	2/7/1997	68.66	106.35
5029	3	2/12/1997	68.66	106.36
5029	2	2/17/1997	68.66	106.35
5029	3	2/22/1997	68.66	106.35
5029	3	3/9/1997	68.66	106.35
5029	3	3/14/1997	68.66	106.35
5029	3	3/19/1997	68.66	106.35
5029	2	3/24/1997	68.67	106.36
5029	3	3/29/1997	68.66	106.34
5029	2	4/3/1997	68.66	106.34
5029	3	4/8/1997	68.67	106.35
5029	3	4/13/1997	68.66	106.35
5029	2	4/18/1997	68.66	106.35
5029	2	4/23/1997	68.66	106.36
5029	3	4/28/1997	68.66	106.34
5029	3	5/3/1997	68.66	106.35
5029	3	5/8/1997	68.66	106.34
5029	3	5/13/1997	68.66	106.34
5029	3	5/15/1997	68.66	106.34

PTT	class	date	Latitude	Longitude
5029	2	5/17/1997	68.66	106.34
5029	3	5/19/1997	68.66	106.34
5029	3	5/20/1997	68.66	106.34
5029	3	5/21/1997	68.66	106.34
5029	2	5/28/1997	68.66	106.34
5029	3	5/29/1997	68.66	106.36
5029	1	5/30/1997	68.66	106.34
5029	1	5/31/1997	68.66	106.34
2119	1	7/10/1996	33.38	111.80
2119	3	7/12/1996	33.38	111.81
2119	1	7/21/1996	71.77	112.80
2119	2	7/22/1996	71.76	112.71
2119	3	7/31/1996	71.77	112.77
2119	1	8/5/1996	71.83	112.92
2119	3	8/10/1996	71.79	112.86
2119	1	8/15/1996	71.79	112.76
2119	1	8/20/1996	71.75	112.66
2119	2	10/9/1996	69.68	108.79
2119	1	10/10/1996	69.63	108.63
2119	1	10/11/1996	69.41	107.39
2119	1	10/12/1996	69.32	107.43
2119	0	10/13/1996	69.08	107.69
2119	1	10/16/1996	69.26	106.87
2119	1	10/19/1996	69.37	106.97
2119	0	10/21/1996	69.34	106.63
2119	0	10/23/1996	69.26	106.02
2119	0	10/25/1996	69.18	105.92
2119	1	10/27/1996	69.19	105.51
2119	1	10/29/1996	68.86	105.90
2119	2	10/31/1996	68.87	105.81
2119	1	11/3/1996	68.88	105.75
2119	2	11/12/1996	68.87	105.75
2119	2	11/14/1996	68.88	105.87
2119	1	11/24/1996	68.86	105.81
2119	3	2/2/1997	68.88	105.81
2119	3	2/7/1997	68.89	105.80
2119	3	2/12/1997	68.88	105.82
2119	3	2/17/1997	68.88	105.82
2119	3	2/22/1997	68.88	105.82
2119	3	2/27/1997	68.88	105.81
2119	3	3/4/1997	68.88	105.83
2119	3	3/9/1997	68.88	105.81
2119	3	3/14/1997	68.88	105.82
2119	3	3/19/1997	68.88	105.82

PTT	class	date	Latitude	Longitude
2119	3	3/24/1997	68.89	105.80
2119	3	3/29/1997	68.88	105.83
2119	3	4/3/1997	68.88	105.82
2119	3	4/8/1997	68.88	105.82
2119	3	4/13/1997	68.88	105.82
2119	3	4/18/1997	68.88	105.82
2119	3	4/23/1997	68.88	105.81
2119	3	4/28/1997	68.88	105.80
2121	0	7/11/1996	33.39	111.81
2121	1	7/21/1996	71.60	113.05
2121	1	7/22/1996	71.59	113.08
2121	3	7/26/1996	71.60	113.04
2121	0	7/27/1996	71.63	112.84
2121	1	7/31/1996	71.60	113.04
2121	2	8/1/1996	71.59	113.09
2121	1	8/5/1996	71.56	113.03
2121	3	8/6/1996	71.56	113.00
2121	1	8/10/1996	71.59	113.28
2121	2	8/15/1996	71.57	112.88
2121	1	8/16/1996	71.56	112.90
2121	1	8/20/1996	71.62	112.93
2121	1	8/21/1996	71.62	112.96
2121	0	8/25/1996	71.62	112.89
2121	1	8/25/1996	71.62	112.86
2121	2	8/26/1996	71.62	112.97
2121	1	8/30/1996	71.56	112.92
2121	1	9/4/1996	71.50	112.86
2121	0	9/5/1996	71.50	112.87
2121	2	9/15/1996	70.31	110.43
2121	1	9/29/1996	69.39	107.93
2121	2	10/3/1996	68.99	107.45
2121	1	10/11/1996	69.24	106.98
2121	0	10/13/1996	69.17	107.32
2121	2	10/14/1996	69.28	106.93
2121	1	10/15/1996	69.22	107.01
2121	3	10/16/1996	69.27	106.93
2121	1	10/18/1996	69.25	106.96
2121	1	10/19/1996	69.35	106.98
2121	1	10/21/1996	69.30	107.07
2121	0	10/23/1996	69.15	107.54
2121	1	10/25/1996	69.19	106.92
2121	2	10/26/1996	69.22	106.95
2121	1	10/27/1996	69.29	106.90
2121	1	10/29/1996	69.13	106.06

PTT	class	date	Latitude	Longitude
2121	0	10/30/1996	68.98	106.22
2121	0	11/1/1996	68.84	106.57
2121	1	11/2/1996	68.77	105.91
2121	1	11/3/1996	68.76	105.89
2121	1	11/6/1996	68.61	106.12
2121	2	11/7/1996	68.67	105.91
2121	3	11/8/1996	68.65	105.86
2121	0	11/9/1996	68.64	105.90
2121	2	11/12/1996	68.62	105.75
2121	0	11/13/1996	68.61	105.75
2121	1	11/14/1996	68.55	105.64
2121	2	11/19/1996	68.60	105.18
2121	2	11/24/1996	68.56	105.00
2121	2	11/29/1996	68.58	104.88
2121	1	01/08/1997	64.40	127.09
2121	1	01/18/1997	68.47	104.51
2121	0	03/09/1997	75.76	62.57
2121	0	03/10/1997	68.30	105.89
2121	1	03/14/1997	68.49	104.69
2121	0	03/19/1997	68.50	105.05
2121	1	03/24/1997	68.54	104.99
2121	1	04/03/1997	66.62	115.57
2121	1	04/08/1997	68.53	104.99
2121	1	04/14/1997	68.54	104.97
2121	1	04/18/1997	68.53	104.78
2121	1	04/19/1997	68.54	104.77
2121	1	04/23/1997	68.55	105.05
2121	1	04/28/1997	68.55	105.05
2121	1	04/29/1997	68.58	104.90
2121	1	05/03/1997	68.58	105.47
2121	1	05/13/1997	68.64	106.06
2121	1	05/15/1997	68.61	106.08
2121	2	05/18/1997	68.59	106.25
2121	1	05/22/1997	68.69	106.68
2121	2	05/28/1997	68.76	106.77
2121	2	05/29/1997	68.76	106.91
2121	1	05/30/1997	68.77	106.86
2121	3	05/31/1997	69.11	107.87
2121	2	06/01/1997	69.13	108.00
2121	2	06/02/1997	69.33	108.48
2121	1	06/04/1997	69.49	109.27
2121	1	06/05/1997	69.50	109.56
2121	2	06/06/1997	69.63	110.25
2121	2	06/07/1997	69.64	110.24
2121	1	06/08/1997	69.32	110.45

PTT	class	date	Latitude	Longitude
2121	1	06/09/1997	69.30	110.46
2121	1	06/10/1997	69.23	110.32
2121	0	06/11/1997	69.24	110.53
2121	2	06/12/1997	69.20	110.26
2121	1	06/14/1997	69.20	110.23
2121	1	06/15/1997	69.23	110.30
2121	1	06/16/1997	69.36	110.33
2121	3	06/18/1997	69.48	110.30
2121	3	06/20/1997	69.71	110.59
2121	2	06/23/1997	69.85	110.81
2121	1	06/24/1997	70.05	110.88
2121	1	06/26/1997	70.16	111.20
2121	1	06/28/1997	70.39	111.49
2121	2	06/29/1997	70.39	111.48
2121	1	07/01/1997	70.54	111.89
2121	1	07/04/1997	70.67	112.24
2121	1	07/06/1997	70.88	112.43
2121	1	07/11/1997	71.17	112.80
2121	1	07/12/1997	71.28	112.95
2121	3	07/16/1997	71.50	112.99
2121	2	07/19/1997	71.40	112.70
2121	1	07/22/1997	71.46	112.85
2121	1	07/23/1997	71.45	112.90
2121	0	08/01/1997	71.55	113.05
2121	1	08/07/1997	71.53	113.21
2121	0	08/11/1997	71.64	112.85
2121	2	08/26/1997	71.58	112.93
2121	1	09/11/1997	71.60	113.03
2121	0	09/16/1997	71.59	113.03
2121	0	10/14/1997	69.24	106.82
2121	0	10/20/1997	69.25	106.04
2121	2	10/23/1997	69.04	105.96
2121	1	10/24/1997	69.11	106.06
2121	1	10/25/1997	69.04	105.89
2121	1	11/02/1997	68.63	106.41
2121	3	11/05/1997	68.56	106.33
2121	1	11/07/1997	68.55	106.44
2121	3	11/08/1997	68.54	106.45
2121	3	11/11/1997	68.53	106.43
2121	1	11/15/1997	68.51	106.84
2121	1	11/21/1997	68.66	106.86
2121	2	12/10/1997	68.81	106.46
2121	1	12/30/1997	68.58	107.17
2121	1	01/14/1998	68.64	107.14
2121	0	01/15/1998	68.65	106.80

PTT	class	date	Latitude	Longitude
2121	1	02/13/1998	68.66	106.80
2121	1	02/19/1998	66.71	117.47
2121	0	02/24/1998	68.55	106.30
2121	2	02/28/1998	68.65	106.62
2121	0	03/30/1998	68.73	106.61
2121	0	03/31/1998	68.72	106.72
2121	1	04/04/1998	61.67	146.28
2121	0	04/09/1998	68.69	106.59
2121	0	04/09/1998	68.69	106.59
2121	2	05/30/1998	71.50	113.02
2121	1	05/31/1998	71.50	113.06
2121	3	06/01/1998	71.52	112.99
2121	3	06/02/1998	71.53	112.99
2121	3	06/07/1998	71.53	113.07
2121	3	06/08/1998	71.53	113.07
2121	1	06/10/1998	71.52	112.90
2121	1	06/12/1998	71.52	112.94
2121	2	06/15/1998	71.53	112.92
2121	1	06/17/1998	71.59	113.08
2121	2	06/19/1998	71.55	113.03
2121	1	06/21/1998	71.52	112.99
2121	0	08/28/1998	71.58	113.05
2121	1	12/02/1998	68.44	106.91
2121	0	12/17/1998	68.56	107.01

APPENDIX F. Numbers and condition of winter-killed caribou, Minto Inlet, July 1991 (L. Buckland).

Hunters in Holman had requested a study of winter-killed caribou during a Wildlife Management Advisory Council meeting (Sachs Harbour, September 1990). If a die-off had occurred, a preponderance of adult male and calf skeletal remains could be expected. Those are the most vulnerable to the effects of malnutrition during energetically costly foraging such as after heavy snowfalls and freezing rain storms. The white fur makes the site of the skeleton relatively conspicuous for 1-2 years, which was the basis for the survey.

Unfortunately, problems with the helicopter lead to the abandonment of the survey before the north side of Minto Inlet - the expected wintering area - could be searched. On the southside of the Inlet, a caribou calf and an old male caribou skeleton were found. Both skeletons were disassembled and had been scavenged by foxes. It was not possible to distinguish a cause of death.